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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/771,267	02/02/2004	Justin K. Brask	042390P15744C	2317

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EXAMINER

NOVACEK, CHRISTY L

ART UNIT PAPER NUMBER

2822

DATE MAILED: 07/01/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/771,267	Applicant(s) BRASK ET AL.	
	Examiner Christy L. Novacek	Art Unit 2822	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 02 February 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 27-31 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 27-31 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>2/2/04</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

This office action is in response to the preliminary amendment filed February 2, 2004.

Specification

The disclosure is objected to because of the following informalities: The first line of the specification should be amended to recite the US Patent Number of parent application 10/387303.

Appropriate correction is required.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 27-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Visokay et al. (US 20030045080, cited in IDS) in view of Boyd et al. (US 6,845,778).

Regarding claim 27, Visokay discloses forming a high-k gate layer on a substrate, the high-k gate dielectric layer having impurities and oxygen, exposing the high-k gate dielectric layer to a solution including hydrogen peroxide at a sufficient time and temperature to remove impurities from the high-k gate dielectric layer and to increase the oxygen content of the high-k gate dielectric layer, and forming a gate electrode on the high-k gate dielectric layer (para. 0023-0033). Visokay does not disclose applying sonic energy while the high-k gate dielectric layer is exposed to the solution that includes hydrogen peroxide. Boyd discloses that it is well-known in the art to use megasonic cleaning to rid semiconductor wafers of impurities because the sonic

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energy applied to the wafers causes the rapid forming and collapsing of microscopic bubbles in a liquid medium under the action of sonic agitation. Upon collapse, the bubbles release energy which assists in particle removal through breaking the various adhesion forces which adhere the particle to the substrate (col. 1, ln. 10-31). Boyd teaches a megasonic cleaning apparatus that uses a hydrogen peroxide solution to clean semiconductor substrates (col. 6, ln. 20-29). At the time of the invention, it would have been obvious to one of ordinary skill in the art to use the megasonic cleaning system taught by Boyd to clean the high-k gate dielectric layer of Visokay because Visokay does not disclose using any particular cleaning apparatus and because Boyd teaches that by applying sonic energy to the cleaning solution, better impurity removal can be obtained.

Regarding claims 28 and 29, Boyd discloses that the sonic energy can be applied at a frequency of 400-1500kHz, while dissipating at 3-5 W/cm² (col. 6, ln. 40-48).

Regarding claims 30 and 31, Visokay discloses that, in one example, the hydrogen peroxide solution is an aqueous solution containing 5% hydrogen peroxide by volume and the high-k gate dielectric layer is exposed to the aqueous solution at a temperature of 65°C for 7 minutes (para. 0024). Visokay does not disclose a range of cleaning parameters. At the time of the invention, it would have been obvious to one of ordinary skill in the art to use routine experimentation to determine optimal H₂O₂ concentrations, time and temperatures at which to conduct the cleaning process of Visokay, depending upon the composition and thickness of the high-k gate dielectric layer because such variables of art recognized importance are subject to routine experimentation and discovery of an optimum value for such variables is obvious. See *In re Aller*, 105 USPQ 233 (CCPA 1955). Note: Applicant's specification, page 6, lines 13-16 states, "The appropriate time and temperature at which high-k gate dielectric layer is exposed [to

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the cleaning solution] may depend upon the desired thickness and other properties for high-k gate dielectric layer 110.”

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

Luscher et al. (US 6,899,111) discloses a megasonic cleaning apparatus configured to clean a semiconductor substrate using hydrogen peroxide and sonic energy.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Christy L. Novacek whose telephone number is (571) 272-1839. The examiner can normally be reached on Monday-Thursday and alternate Fridays 7:30 - 5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian can be reached on (571) 272-1852. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

CLN
June 24, 2005


AMIR ZARABIAN
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800